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Assessment of Australian sea lion pup abundance at Olive and Jones Islands: 2015/16

Simon D Goldsworthy, Fred Bailleul, Alice I Mackay and Dirk Holman

SARDI Publication No. F2016/000551-1
SARDI Research Report Series No. 936

SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022

December 2016

Report to Taronga Zoo, Taronga Field Conservation Grants

PREMIUM FOOD AND WINE FROM OUR CLEAN ENVIRONMENT

Government of South Australia
Department of Environment, Water and Natural Resources

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This publication may be cited as:
Goldsworthy, S. D.[1], Bailleul, F.[1], Mackay, A. I.[1] and Holman, D.[2] (2016). Assessment of Australian sea lion pup abundance at Olive and Jones Islands: 2015/16. Report to Taronga Zoo, Taronga Field Conservation Grants. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2016/000551-1. SARDI Research Report Series No. 936. 17pp.

Cover Photos: Simon D. Goldsworthy

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Printed in Adelaide: December 2016

SARDI Publication No. F2016/000551-1
SARDI Research Report Series No. 936

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Signed:

Date: 19 December 2016

Distribution: Taronga Zoo, SAASC Library, SARDI Waite Executive Library, Parliamentary Library, State Library and National Library

Circulation: Public Domain

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ACKNOWLEDGEMENTS

We thank the Taronga Field Conservation Grants scheme for funding this project. The work was conducted under an animal ethics approval from the Primary Industries and Regions SA (PIRSA) Animal Ethics Committee (AEC) (32/12), and under permit from the South Australian Department of Environment, Water and Natural Resources (DEWNR) (Permit number: A24684-14). We thank Frank Kutsche (DEWNR) for provision of DEWNR Permits.

We thank Pat Walsh and Mel Stonnill (DEWNR), Ben Pitcher, Kaja Wierucka and Rob Harcourt (Macquarie University), and Alan Payne (Baird Bay Ocean Eco Experience) and Darren Guidera for logistic support.

We also thank Kathryn Wiltshire and Nicole Patten (SARDI) for reviewing the draft report.

EXECUTIVE SUMMARY

This report provides information on Australian sea lion (ASL) pup abundance for the Jones and Olive Island breeding sites off the western Eyre Peninsula in the Chain of Bays region of South Australia for the 2015/16 breeding season. Survey results estimate the pup abundance to be 25 for Jones Island based on a ground count undertaken on 7 April 2016. Trend analysis for pup count data over nine breeding seasons at Jones Island (between 2005 and 2015/16) suggests that pup abundance is currently increasing by ~3.8% per year. For Olive Island, two surveys were undertaken in April and June 2016 involving direct counts of live and dead pups, a mark-recapture procedure and the cumulative pup production method. The pup abundance at Olive Island for the 2015/16 breeding season was estimated to be 135 (95% CL 118-151). Trend analysis over ten breeding seasons at Olive Island between 2005 and 2015/16 indicates that pup abundance has been declining by ~3.7% per year. The Olive and Jones Island surveys undertaken as part of this study extend the time series of monitoring for these key sites, a key objective and action of the ASL Recovery Plan, and will help assess the effectiveness of bycatch mitigation measures introduced into the Commonwealth Gillnet Hook and Trap Fishery (GHAT) off South Australia.

1 INTRODUCTION

The Australian sea lion (ASL), *Neophoca cinerea* was listed as Threatened under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* in February 2005. In South Australia, it was listed in February 2008 as Vulnerable under the *National Parks and Wildlife Act 1972*. In October 2008, the International Union for the Conservation of Nature (IUCN) upgraded its listing of the ASL to Endangered (Goldsworthy 2015).

Population surveys indicate that marked declines in ASL pup abundance have occurred across the South Australian populations over the last two decades, with a mean annual rate of decline of 2.9% per year (Goldsworthy et al. 2015). The major threatening process limiting the recovery of ASL populations is incidental bycatch mortality, especially in demersal gillnet fisheries (Department of Sustainability Environment Water Population and Communities 2013, Goldsworthy et al. 2010b). Between 2010 and 2012, the Australian Fisheries Management Authority (AFMA) introduced a range of management measures into the Gillnet Hook and Trap Fishery (GHAT) off South Australian to mitigate bycatch of ASL including spatial closures, electronic monitoring, and bycatch trigger limits (AFMA 2015). Monitoring the change in pup abundance at a range of ASL breeding sites is important to assess whether bycatch mitigation measures introduced into the fishery are enabling the recovery of populations.

This project contributes to the monitoring of ASL pup production at two key breeding sites (Olive and Jones Islands) off the western Eyre Peninsula that form important performance indicators for the success of fisheries bycatch mitigation measures and the species Recovery Plan (Department of Sustainability Environment Water Population and Communities 2013).

2 METHODS

Jones Island (33.185° S, 134.367° E) is situated at the entrance of Baird Bay on the west coast of the Eyre Peninsula, and was accessed by vessel from the settlement at Baird Bay. The island was visited on one occasion during which a ground survey of pups was undertaken (7 April 2016).

Olive Island (32.719° S, 133.695° E) was accessed by vessel from Streaky Bay. Surveys were conducted between 9 and 19 April and between 21 and 22 June 2016. Two survey methods were used to estimate pup abundance: direct counts of live and dead pups, and the cumulative pup production method, the latter which involves a mark-recapture procedure. Detailed methodology for these is described in Goldsworthy et al. (2015).

To estimate trends in abundance, we used the method developed by Johnson and Fritz (2014). It uses a Bayesian modelling and Markov Chain Monte Carlo method and a hierarchical model to make inferences of trends in abundance. Analyses were undertaken using the R package 'agTrend' (Johnson and Fritz 2014). Details of their application and the source and use of historic time-series data for both sites are described in Goldsworthy et al. (2015).

3 RESULTS

3.1 Jones Island

The 2015/16 ASL breeding season is estimated to have commenced in December 2015, with the first new-born pup (~2 weeks old) observed on 29 December 2015 (Alan Payne pers. comm.). A ground count of Jones Island was undertaken 100 days (3.3 months) later at the end of the breeding season on 7 April 2016. A total of 25 pups were counted (5 black, 16 brown, 0 moulted and 4 dead).

Trends analysis for pup count data over nine breeding season at Jones Island between 2005 and 2015/16 are plotted in Figure 1. Results from agTrend analysis indicate that pup abundance has been increasing at Jones Island by ~3.8% per year, or by ~5.7% per breeding season (Table 1).

3.2 Olive Island

Two surveys of ASL pup abundance were undertaken at Olive Island: 9-19 April and 21-22 June 2016. A ground survey undertaken on 18 April 2016 counted a total of 87 pups: 23 black pups (7 with mate-guarded mothers), 49 brown and 15 dead (Table 1). A ground survey undertaken on 21 June 2016 counted 89 pups: 78 brown, 10 moulted and 1 new dead pup (Table 2). Between 9-16 April 2016, a total of 42 pups were flipper tagged and 27 pups were bleach/clipped giving a total of 69 individually identifiable pups. Mark-recapture surveys undertaken on 18-19 April 2016 (utilising 69 individually identifiable pups), resulted in Petersen estimates of 120 live pups (95% CL 112-128), and 135 (95% CL 127-143) in total including dead pups (Table 2).

A mark-recapture survey undertaken on 21-22 June 2016 (utilising resights of 39 of the 42 flipper tagged pups from April), resulted in Petersen estimates of 103 live pups (95% CL 95-111) (Table 2), and 119 (95% CL 111-127) in total including dead pups. Based on tag re-sights between the first and second survey, the apparent survival rate (φ) was 0.929 (sd = 0.040). Using the Petersen estimates and cumulative pup production method, the net change in pup numbers between the first and second survey was estimated to be -8 (95% CL, -23 to 6). The net negative change in pup abundance between surveys suggests that the April survey is likely to have been undertaken near the end of the breeding season. Assuming no net increase in pup production between surveys (with 95% CL, 0 to 6), the overall estimate of pup production at Olive Island for the 2015/16 breeding season is 135 (95% CL 118-151) (Table 2).

Trend analysis for pup count data over ten breeding seasons at Olive Island between 2003/04 and 2015/16 is plotted in Figure 2 (pre-2016 data sourced from Goldsworthy et al. 2015). Results from agTrend analysis indicate that pup abundance has been declining at Olive Island by ~3.7% per year, or by ~5.6% per breeding season (Table 1).

4 DISCUSSION

The first record of breeding by ASL at Jones Island was in August 1977 (2 pups) based on a ground survey, and the next survey when pups were seen was not until December 1990 (5 pups; Gales et al. 1994). More complete ground count data are available for five breeding seasons: 1998/99 (9 pups), 2000 (6 pups), 2001/02 (12 pups), 2003 (7 pups) and 2004/05 (15 pups) (McKenzie et al. 2005). No data were obtained for the 2006 breeding season. The count of pup abundance for the 2007 season was 15 (Goldsworthy et al. 2010a). In the 2007/08 season a minimum of 11 pups were sighted (Goldsworthy et al. 2010a). In the 2010 season, 28 pups were counted, but given the advanced state of pups (most were fully moulted) and the marked increase in numbers from previous seasons, it is probable that many had swum in from neighbouring colonies (such as West Waldegrave and Nicolas Baudin Islands, and Point Labatt) and therefore the estimate for that season was most likely inflated (Goldsworthy et al. 2012). Flipper tagged pups that were marked at Nicolas Baudin Island in June 2013 were reported present at Jones Island in September 2013 through to March 2014 (Alan Payne pers comm.), supporting the idea that high pup counts at Jones Island in the 2010 season were probably a result of the presence of pups from other islands. The estimate for the 2011/12 season was 12 pups, for 2013/14 was 16 pups, for the 2014 breeding season was 19 pups, and for this most recent breeding season (2015/16) was 25. Estimates of trends in pup abundance between the 2005 and 2015/16 at Jones Island, including the agTrend analysis suggest an increase in pup numbers has occurred over the last three breeding seasons (since 2013/14).

Olive Island was recorded as a breeding colony in November 1977 when 52 pups were seen (Shaughnessy et al. 2005). Pups were also seen in April 1979 (49 unclassed) (Ling and Walker 1979) and November 1990 (27 moulted and one dead)(Gales et al. 1994, Shaughnessy et al. 2005). Based on three ground counts undertaken between February and July 2003, 121 pups were counted (McKenzie et al. 2005). Ground counts undertaken in September 2004 and January 2005 (2004/05 season) estimated 131 pups (Shaughnessy et al. 2005). During the 2006 season, the highest ground count was 150 pups and cumulative pup production estimates were 192 (95% CL 183-201), and for 2007 was 159 (95% CL 138 – 181) (Goldsworthy et al. 2007). The estimate for the 2008/09 breeding season using similar methods was 221 (95% CL 195 – 247), for the 2010 breeding season was 184 (95% CL 165 – 204), for the 2011/12 breeding season was 129 (95% CL 114 – 144), for the 2013 breeding season was 140 (95% CL, 123-156) and for the 2014 season it was 133 (95% CL 118 – 14) (Goldsworthy et al. 2012, 2013, 2014, 2015). The estimate for the 2015/16 season was 135 pups. Changes in pup abundance on Olive Island between 2003/04 and 2015/16 indicates a decline of ~3.7% per

year, or by ~5.6% per breeding season. This is similar to the rates of decline estimated using the agTrend method with historic data up to the 2014 breeding season, which indicated a decline of 4.4% per year, or 6.5% per breeding season (Goldsworthy et al. 2015).

The South Australian ASL population accounts for around 85% of the species abundance, and a recent major assessment of its status and trends in abundance identified a smaller total pup abundance than expected (~2,500 per breeding cycle), declining pup abundance at most (82%) breeding sites and an overall rate of decline estimated to be 2.9% per year (or 4.4% per breeding cycle) (Goldsworthy et al. 2015). Olive and Jones Island represent two of eight key monitoring sites for the species in South Australia, and the key monitoring sites for the Chain of Bays region (Goldsworthy et al. 2015).

The Olive and Jones Island surveys undertaken as part of this study are important as they extend the time series of monitoring for these key sites, particularly given the broad scale regional declines identified for the species. These surveys also meet some of the key objectives and actions of the ASL Recovery Plan, in particular the need to 'develop and apply a quantitative framework to assess the population status and potential recovery of the ASL across its range' (Priority 1), and 'ensure [that] sufficient and effective abundance and distribution monitoring is in place to adequately understand population size and trends at representative sites … including at the fringes of the species' range' (Department of Sustainability Environment Water Population and Communities 2013). The continued monitoring of these and other sites will be important in assessing if the bycatch mitigation and management measures introduced into the Gillnet Hook and Trap Fishery (GHAT) off South Australia by AFMA (AFMA 2015), have been effective and adequate to reverse declining trends, and to assess if there are other potential factors that may be contributing to declines.

Table 1. Trend estimates for Australian sea lion pup numbers at Olive and Jones Islands calculated using the hierarchical modelling and Bayesian inference methodology (see Johnson and Fritz 2014). Trend estimates are given for the posterior median, and lower and upper 90% highest probability density credible intervals (CI) of λ by year and by breeding season (1.5 years).

Site	Year range	λ yr^{-1}			λ breeding season^{-1}		
		Median	Lower CI	Upper CI	Median	Lower CI	Upper CI
Jones Is.	2005-2015/16	3.77	-2.95	10.27	5.66	-4.42	15.40
Olive Is.	2003/04-2015/16	-3.71	-6.24	-1.02	-5.57	-9.36	-1.53

Table 2. Summary of abundance estimates of ASL pups at Olive Island in the 2015/16 breeding season: counts, tagging, cumulative mortalities and various direct count and mark-recapture estimates, during two surveys between April and June 2016.

		Survey	**1**	**2**
		Date	**18 April**	**21 June**
i)	**Pup counts**			
		Black (MG)	7	0
		Black	16	0
		Brown	49	78
		Moulted	0	10
		Dead	15	1
		Total	87	89
ii)	**Pup marking, counts and cumulative dead**			
		Cumulative tagged	42	42
		M	69*	39
		Maximum unmarked counted	39	58
		Maximum count (live)	72	88
		Cumulative dead (unmarked)	15	16
		Cumulative dead (marked)	0	0
		Total accumulative dead	15	16
		Maximum count (live) + cumulative dead	87	104
		Cumulative marked + dead (unmarked) + max unmarked	92	121
iii)	**Petersen estimates**			
		Petersen Estimate (live)	**120**	**103**
		Petersen Estimate Lower – Upper CL	**112-128**	**95-111**
iv)	**Cumulative pup production between surveys**			
		Available for resighting		42
		Number resighted		39
		Apparent survival (φ) between sessions		0.929
		Variance (φ)		0.002
		sd (φ)		0.040
		Net pup production between surveys ($\hat{B}$)		-8 (0)*
		Variance ($\hat{B}$)		54
		Lower CL		-23 (0)*
		Upper CL		6
		Estimated pup production	**135**	**135**
		Lower – Upper CL		**118-151**

*includes an additional 27 pups that were given temporary bleach and clip marks.

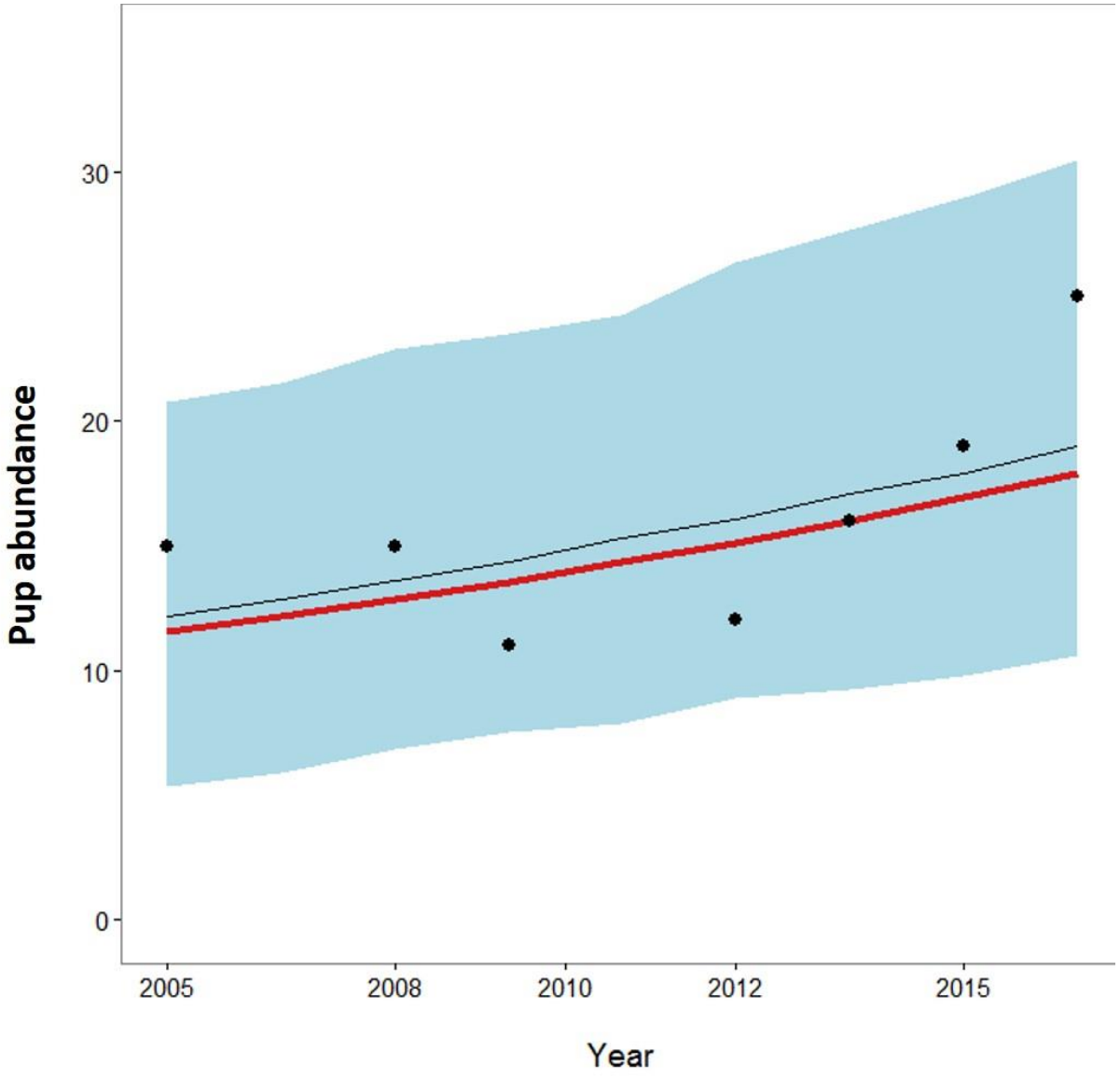

Figure 1. Trends in the abundance of Australian sea lion pups at Jones Island based on pup counts undertaken over nine breeding seasons between 2005 and 2015/16. The blue envelope is the 90% highest probability density credible intervals. The red line is the fitted least-squares predictive trend and the black line is the median of the posterior predictive counts.

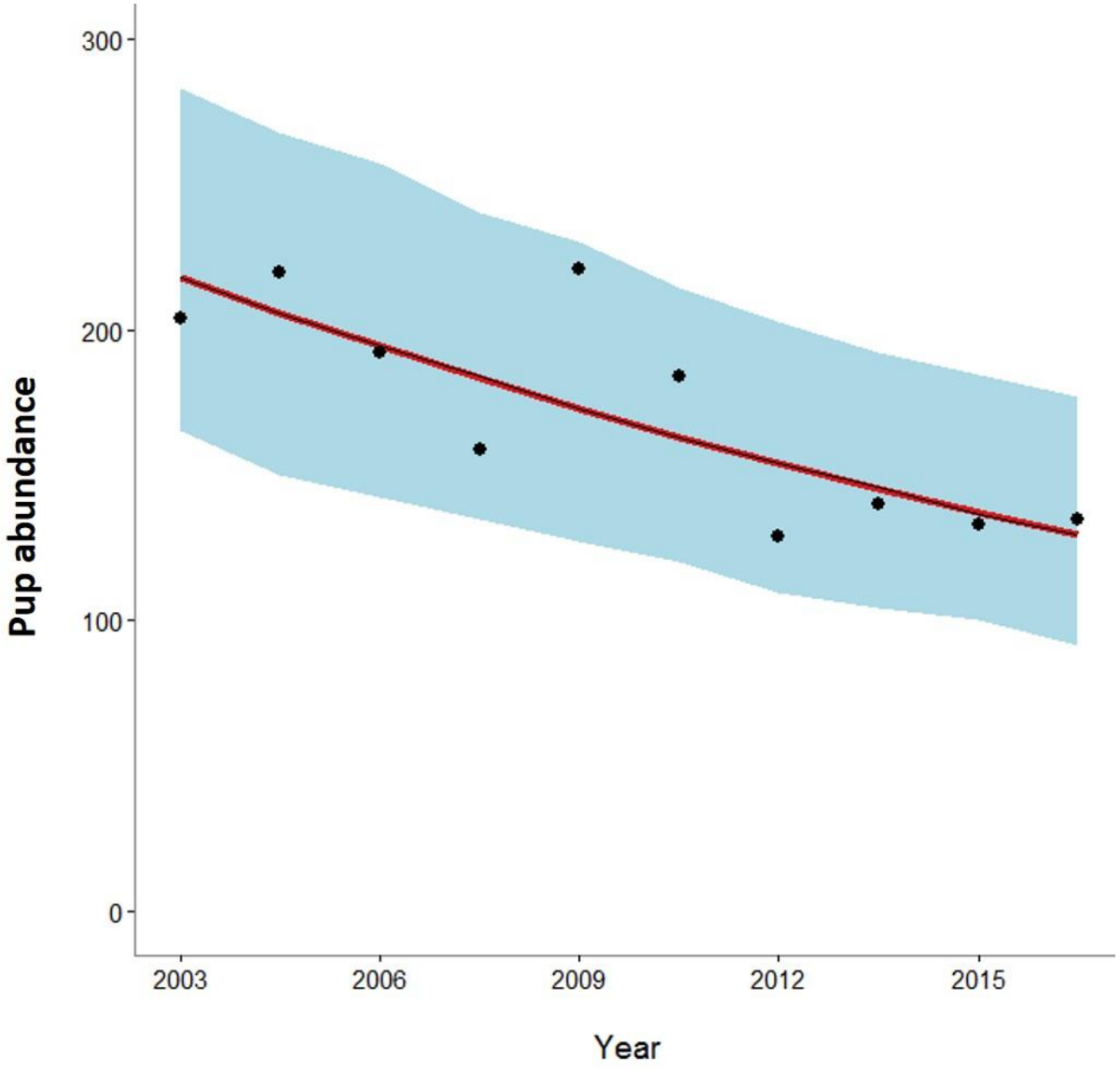

Figure 2. Trends in the abundance of Australian sea lion pups at Olive Island based on pup count and cumulative pup production survey methods over 10 breeding seasons between 2003/04 and 2015/16. The blue envelope is the 90% highest probability density credible intervals. The red line is the fitted least-squares predictive trend and the black line is the median of the posterior predictive counts.

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